

## Oral Biofilms and Targeted Therapeutics-Present and Future

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To survive in adverse condition bacteria forms unique structures called biofilms. They are basically viable micro-communities encapsulated in secreted polysaccharide capable of resisting hostile environment [1]. Almost all biofilms are marked with the common feature of altering gene expression or substrate specificity of expressed genes. Such alterations impair therapeutic targeting against specific proteins within these homogeneously and heterogeneously encapsulated microbial communities. A functional biofilm cycle consists of three stages- a) Planktonic stage, b) Biofilm phase and c) dispersion [1,2]. Human teeth and oral cavities are marked by biofilm development which includes: i) Dental plaques, ii) dentures and iii) implants. In dental plaques crosstalk within the heterogenic microbes encapsulated in polysaccharide membrane results in the formation of this archetypical biofilm. Microorganism involved in plaque formation include *Lactobacillus* sp, *Streptococcus mutans*, *S. sobrinus* and *Veillonella* spp [4]. Nutritional end product of one microbe serving as substrate for other allows them survive in the adverse conditions within dental plaques. The ability of the heterogenous pathogens to impede antibiotic resistance makes them really difficult to eradicate. Denture material polymethyl acrylate (PMA) is a common colonization substrate for *Candida albicans* [5]. Such colonization stimulates formation of stomatitis - an inflammation of gum. Dental implants especially titanium materials serve as common substrates for bacteria forming biofilms in oral cavities which exhibit inflammation and swelling of peri-implant tissues as studied in case of *Streptococcus mutans* and *Porphyromonas gingivalis*. The characteristic feature of such event is marked by occurrence of subgingival microbiota similar to those of the natural teeth with periodontitis [6,7].

Oral biofilms with encapsulated heterogenous microbes are marked with high resistance to antibiotics and chemotherapeutic agent due to lack of oxygen, low metabolism rate and horizontal gene transfer [2]. Targeting them thus becomes challenging and requires the advent of natural, semisynthetic or synthetic therapeutic peptides. Naturally occurring AMPs (Anti-microbial peptides) in human are effective mostly against particular strains or species of microbial genus that induce oral biofilms. However, their specificity is less effective for heterogenic complex communities. Colonization of such heterogenous encapsulated microbes during oral infections and treatment using therapeutics is thus highly demanding. In this context, naturally occurring antimicrobial peptides (AMPs) are bioengineered to overcome such resistance [8]. Reports indicate use of antibiotics, nano-particles, in combination of AMPs can prove vital for disruption of biofilms. Use of HBD3-C15 (Human beta defensin3 with engineered GKSTRGRKCCRRKK at C-terminal end) against *Enterococcus* sp, *Streptococcus* sp and *C. albicans* is one of the best examples of bioengineered peptide that is effective for heterogenic community involved in oral biofilms [9]. Future work defining bioengineered form of AMP that are involved in targeting wide spectrum of microbial genus in a heterogenic community might prove essential to overcome antibiotic resistance in oral biofilm. Treatment of plaque formation in dental infections to target microbes within biofilm also includes use of synthetic auto-inducer peptides with possibility of using D-amino acids. Stimuli dependent peptides might also prove essential for inhibiting quorum sensing signals in oral biofilm formation [10]. Silver nanoparticles and their chemical conjugates used independently or in combination with antibiotics are potential good therapeutics against complex biofilms.

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